

# Reduced Shielding, Rugged, Scalable-Electrical Power Converter for Fission-Power Systems, Phase I

Completed Technology Project (2018 - 2019)



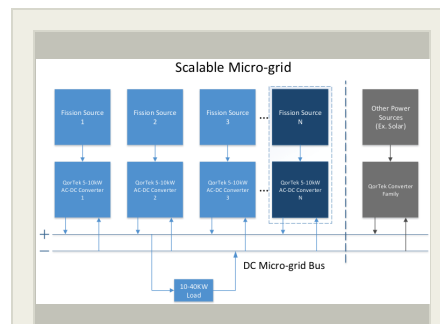
## Project Introduction

NASA Fission Surface Power Generation systems are weight challenged based mostly on the very conservative radiation tolerance specification of COTS components and in terms of lander limitations for surface operational uses. The proposed programs will drastically reduce both the mass of the shielding and the amount of shielding necessary to protect power and control electronics. Moreover, it enables flexibility of adding additional fission power sources in a manner that maximizes overall conversion of power generator outputs to maximum usable power, even if one unit degrades or fails. The new solution approach leverages two decades of previous work for the US Navy in extremely high specific power controllers and power systems and recent efforts for the Army in extremely high efficiency power conversion. In addition, QorTek will use and expand its catalog of COTS component radiation ratings through continued testing and documentation throughout the program. Integration of state-of-the-art technologies such as SiC and GaN MOSFETs, micro-channel oscillating heat pipes, and digital control systems will enable an unparalleled level of system control while providing a solution focused on extreme environmental conditions required for long duration surface power missions. Combining state of the art power and control solutions with verified radhard test data, QorTek will provide NASA missions the ability to have mass effective PMAD system hardware with minimal protection through shielding. This novel system will be developed through to brassboard hardware demonstration in the Phase I and exhaustive testing in Phase II.

## Anticipated Benefits

The proposed power converter has many NASA applications such as Kilopower, Radioisotope Power Systems (RPS), planetary and lunar surface power requirements. Scaled-use cases include several leading micro propulsion systems to develop a power conversion system that commonly meets the compact/micro-thruster mission needs for both CubeSats and SmallSats; similarly, the technology has use in larger propulsion systems for both launch and space operations.

The WBG switching converter is also relevant to many non-NASA applications such as military and commercial SmallSats where these will function as a very high performance, fault tolerant power bus that can substantially impact the size/weight of these systems. The proposed very radhard, compact, lightweight converters here proposed would represent excellent solution larger, long mission duration, commercial and military observation and communication satellite operating at higher MEO/GEO orbits.



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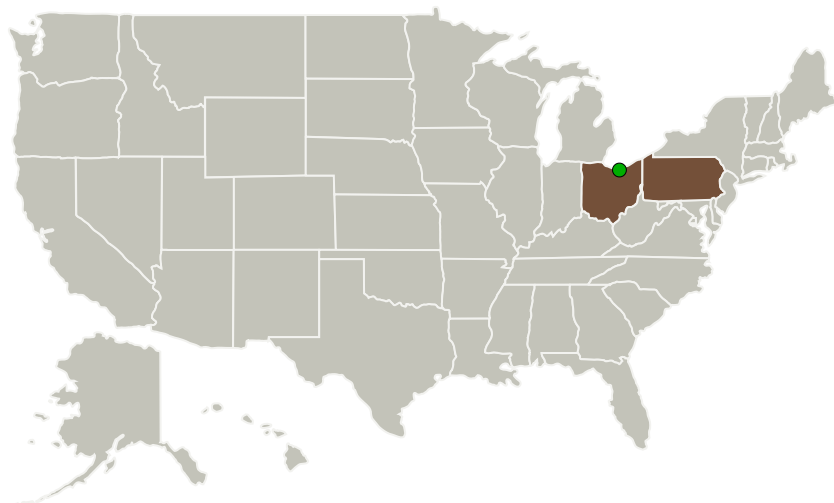
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
QorTek Inc	Lead Organization	Industry Small Disadvantaged Business (SDB)	Williamsport, Pennsylvania
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

Ohio	Pennsylvania
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## Project Transitions

▶ **July 2018:** Project Start

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

QorTek Inc

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

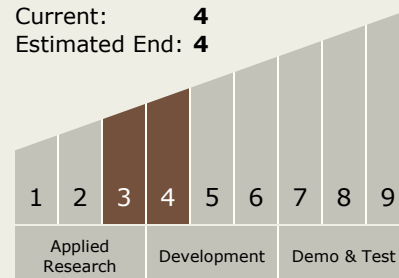
Ross W Bird

## Technology Maturity (TRL)

Start: 3

Current: 4

Estimated End: 4



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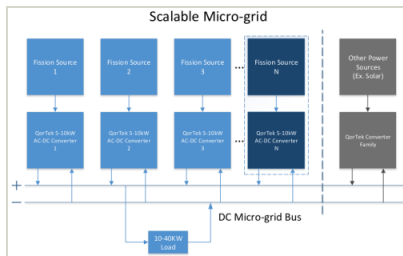


✓ **February 2019:** Closed out

## Closeout Documentation:

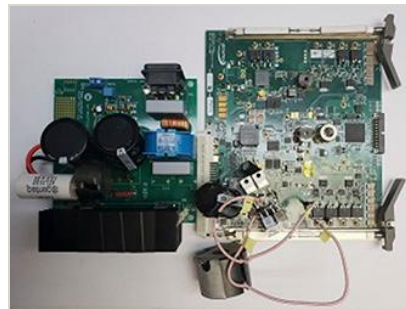
- Final Summary Chart(<https://techport.nasa.gov/file/141261>)

## Images



### Briefing Chart Image

Reduced Shielding, Rugged, Scalable-Electrical Power Converter for Fission-Power Systems, Phase I (<https://techport.nasa.gov/image/131214>)



### Final Summary Chart Image

Reduced Shielding, Rugged, Scalable-Electrical Power Converter for Fission-Power Systems, Phase I (<https://techport.nasa.gov/image/134782>)

## Technology Areas

### Primary:

- TX03 Aerospace Power and Energy Storage
  - └ TX03.3 Power Management and Distribution
    - └ TX03.3.3 Electrical Power Conversion and Regulation

## Target Destinations

Earth, The Moon, Mars